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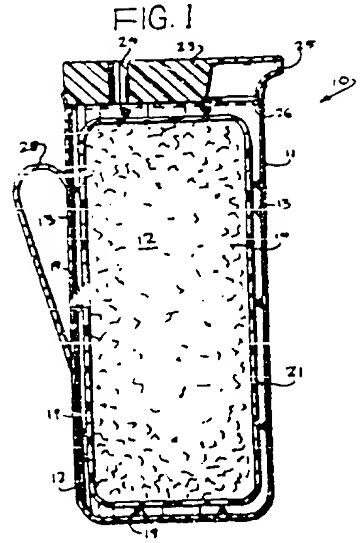
(54) **Portable water purification devices using low density activated carbon.**

(57) In order to provide high fill and pour rates, while still providing effective treatment of water to remove pollutants from it (such as organic contaminants, protozoa, etc.), a water pollutant removal material (14) is disposed in a low volume configuration within a container (10), having a void volume of about 40-90% (e.g. 60-90%). The water pollutant removal material may be activated carbon loaded on a non-woven cloth (15), loose fiber or chip, paper, foam, felt or like fibrous low density material. The activated carbon impregnated materials may be placed in the container, (e.g. by rolling up an impregnated sheet into a spiral roll (16)) and may be disposed within a retention filter (20) which is spaced from the interior walls of the container. Biocide material (e.g. an iodine compound) may be used in addition to or in place of activated carbon, in a low volume configuration.

FIG. 1



PORTABLE WATER PURIFICATION DEVICES USING LOW DENSITY ACTIVATED CARBON

BACKGROUND AND SUMMARY OF THE INVENTION

There are many places throughout the world where it is very desirable to utilize some sort of a water purification device in association with tap water. Such devices are preferably used to remove organics within the tap water, although they can be designed and utilized to remove other pollutants besides organics. There are a wide variety of different types of water purification devices. Most relatively inexpensive units, however, either suffer from low removal efficiencies, or low pour and fill rates. Even some expensive units may suffer from such difficulties. Some units also have problems with bacteria growth, particularly units that contain activated carbon and operate at room temperature.

Typical activated carbon units often have low residence times because there is insufficient time for the water to be in contact with the activated carbon as the water passes through the activated carbon. The residence time can be increased by increasing the amount of activated carbon, however this has practical limits due to the weight of activated carbon. For example a one gallon container filled with particulate activated carbon would weigh four to five pounds. That would also leave very little room for water to be treated. Increasing the amount of activated carbon in a typical unit also results in an increased resistance to the flow of water, thus it may become impractical to operate the unit without applying pressure or vacuum.

According to the invention it has been found that it is possible to provide a high residence time for water in contact with a water pollutant removal material, such as activated carbon, while at the same time providing high fill and pour rates. This can be done inexpensively, without increasing drastically the weight of the treatment unit, and is accomplished by providing the water pollutant removal material in a low volume configuration.

A "low volume configuration" -- as that term is used in the instant specification and claims --refers to a configuration in which the material is uniformly disposed throughout a particular volume, but yet actually only occupies a small percentage of the actual volume. Typical low volume configurations that the water pollutant removal material could have are open cell foams (e.g. urethane foams), felts, paper, woven and non-woven "cloth". For example polyester or rayon material having a thickness of at least about one-eighth inch and a weight of at least about three ounces per square yard may be impregnated with activated carbon and binder. The amount of activated carbon and binder may be a multiple of the weight of the non-woven -- for example the weight of the activated carbon and binder could be twice as great as the weight of the non-woven itself. Such a product has a "low volume configuration" because it actually occupies only about 10-60% (e.g. 10-40%) of the volume in which it is disposed -- that is it has a void volume of about 40-90% (e.g. preferably 60-90%). One desirable way to dispose such a product within the volume is to roll it up into a spiral roll. For example the width of the non-woven carbon impregnated sheet could be substantially the same as the height of a container in which it is disposed, thereby being substantially uniformly disposed within the container.

The low volume configuration water pollutant removal material typically is disposed in a container having an inlet and an outlet. Also the container preferably has means defining a liquid path from the inlet to the outlet which requires the liquid to pass through the material. For example the material could be disposed within a retention filter, and be required to pass through the material before it moves through the retention filter to an annular passageway adjacent the interior walls of the container. The annular passageway would be formed by a plurality of spacers extending from the interior walls of the container into contact with the retention filter. A wide variety of different configurations of inlets, outlets, and water pollutant removal materials may be provided. The whole purpose is to provide sufficient residence time of the material in contact with the water, while still providing high fill and pour rates.

More than one water pollutant removal material may be provided within the container. For example the water may be forced to flow through a biocide material before flowing into contact with activated carbon, or vice versa. The biocide material and activated carbon would both be provided in low volume configurations (e.g. impregnated non-wovens, or the like). Another example of plurality of function would be a device where chelating ion-exchange resins are bound concurrently with activated carbon onto a substrate providing a low volume configuration.

According to another aspect of the present invention there is provided a method of purifying tap water utilizing a container including a water pollutant removal material in a low volume configuration. The method comprises the following steps: (a) Filling the container with water directly from the tap at a rate of at least about one half gallon per minute. (b) Maintaining the tap water in the container at least about 30 seconds, in

contact with the material, to effect removal of pollutants therefrom. And, (c) pouring purified water from the container at a pour rate of at least one half gallon per minute. Preferably, the water pollutant removal material comprises activated carbon, and step (b) is practiced so as to effect removal of at least 85% of the organic contaminants of the tap water. Preferably, step (b) is practiced by filling about 10-40% of the interior volume of the container in a substantially uniform configuration with activated carbon in a porous low volume form. That is the activated carbon has a void volume of about 40-90% (e.g. 60-90%).

It is the primary object of the present invention to provide for the effective removal of water pollutants from tap water or the like, in an inexpensive manner, while providing high pour and fill rates. This and other objects of the invention will become clear from an inspection of the detailed description of the invention and from the appended claims.

BRIEF DESCRIPTION OF THE DRAWINGS

FIGURE 1 is a side view, partly in cross-section and partly in elevation, of a first embodiment of a container according to the present invention;

FIGURE 2 is a perspective view of an exemplary configuration that the water pollutant removal material in the container of FIGURE 1 may have, the material being shown as it is being rolled up;

FIGURES 3 through 7 are side views, partly in cross-section and partly in elevation, of several other embodiments that the top of the container of FIGURE 1 could have;

FIGURES 8 and 9 are side views, partly in cross-section and partly in elevation, of exemplary configurations of a container these embodiments illustrating two different water pollutant materials in low volume configurations disposed within the container;

FIGURE 10 is a side cross-sectional view of an exemplary easily transportable unit for purifying water; and

FIGURE 11 is a side cross-sectional view of a relatively large semi-stationary water purification device designed to be placed in a refrigerator.

DETAILED DESCRIPTION OF THE DRAWINGS

An exemplary container according to the present invention is shown generally by reference numeral 10 in FIGURE 1. The device includes a body 11 having a hollow interior of a given effective volume, the hollow interior being shown generally by reference numeral 12. The hollow interior is defined by interior walls 13. Disposed within the interior volume 12 is a water pollutant removal material, in a low volume configuration, 14. The material can be in a wide variety of different actual shapes or forms. For example non-woven "cloth", paper, felt, and foams are all configurations that can have the water pollutant removal material impregnated thereon, yet be in a "low volume" configuration --i.e. actually take up only a small percentage of the space that they actually occupy. Typically, it is desirable to have the water pollutant removal material 14 about 10-60% (e.g. 10-40%) of the effective volume 12 -- i.e. actually have a void volume of 40-90% (e.g. 60-90%). That is, even though the material 14 may be substantially uniformly distributed throughout the entire volume 12, it only actually occupies, e.g., 10-40% of the volume.

The material 14 is shown in a particularly desirable configuration in FIGURE 2. In this configuration it comprises a sheet 15 that has been formed into a spiral roll 16. The roll has a width 17, which is substantially comparable to the interior height of the volume 12. Even though the material 14 is disposed in almost the entire volume 12 of the device 10, it only actually occupies 10-40%, i.e. it has a void volume of about 60-90%, which void volume can be filled with water in intimate contact with the water pollutant removal material.

The water pollutant removal material may be selected from a wide variety of materials. For example it could be an ion exchange resin, a biocide (e.g. an iodine complex), activated carbon, etc. Activated carbon is the most common form that the material will take when the device 10 is to be utilized for removal of organics. In fact non-woven sheets and foams impregnated with activated carbon are already commercially available, and such commercially available constituents may be utilized in the device 10.

It is desirable -- as illustrated in FIGURE 1 -- to provide spacers 19 uniformly distributed along the interior wall 13 of the container 11. The spacers 19 are designed to engage a retention filter 20 or the like, to form an annular, enveloping, space 21 between the interior walls 13 and the retention filter 20. Such a space typically would have a width of about 1/16 - 1/8 inch. The purpose of the retention filter 20 is to

prevent any carbon particles, or the like, that do come loose from the fibers on which they have been impregnated, from flowing out of the container 11, while filtering out some large particles so they do not enter material 14. The retention filter 20 is preferably be designed to retain carbon particles that became detached and have a size of about 20-40 microns.

The retention filter 20 may be utilized to remove suspended solids and keep in particles of activated carbon that may become loosened, or it may also act as a protozoa filter. In the latter case it would have to have a pore size of less than 2.5 microns.

The container 11 also includes a lid 23, which is basically hollow, and has an inlet passage 24, and an outlet, or pour spout, 25. A perforated plate retainer (such as a perforated plastic plate), which also has spacers thereon, is preferably provided between the lid 23 and the top of the retention filter 20.

A particular form of the water pollutant removal material -- when organics are to be removed -- that is suitable according to the present invention is a non-woven sheet of polyester or rayon that has been impregnated with carbon and a binder. The void volume of such "cloth" is typically about 60-90%. For example sheets of such polyester non-woven having thicknesses of 1/8 inch to about 1/2 inch and weights ranging from about 3.2 ounces per square yard to about 12 ounces per square yard have been tested. In each case the cloth has been impregnated with 200% "add on" of a combination of activated carbon and binder. That is if the greig weight of the non-woven is 3.2 ounces per square yard, it is impregnated with about 6.4 ounces of carbon and binder, an add on of 200%. Such material can be rolled up in a configuration illustrated in FIGURE 2, and provides excellent removal of organics and certain inorganics from water within the container 11. However as previously mentioned a wide variety of other materials, such as urethane foam impregnated with activated carbon, carbon impregnated papers and felts, and the like, may be provided. Polyester or rayon non-woven cloth impregnated with carbon and binder are particularly advantageous since they may be purchased commercially, are for the most part readily wettable, and can be made from FDA approved materials. The activated carbon may be added to other fibers, or be in fibrous form itself.

The configuration of impregnated water treatment material is not restricted to inherently bonded materials such as fabrics, rather the design is intended to include loose materials such as impregnated fibers or chips of impregnated non-wovens which remain uniformly dispersed upon filling the device with water.

An example of a particularly useful material 14 is a non-woven impregnated with about 200% add on of activated carbon having a void volume of about 70%, in a spiral roll configuration. Using such material (the non-woven was either polyester or polyurethane), the results in TABLE I were achieved.

TABLE I

Residence	Concentration	% Removal
Safranin O Removal		
Polyester Base Material		
0 min	10,000 ppb	0
1 min	2,700 ppb	73%
5 min	1,100 ppb	89%
20 min	300 ppb	97%
60 min	230 ppb	97.7%
120 min	50 ppb	99.5%
Polyurethane Base Material		
0 min	10,000 ppb	0
1 min	1,400 ppb	86%
5 min	400 ppb	96%
20 min	100 ppb	99%
60 min	80 ppb	99.2%

Iodine Removal

Polyester Base Material

Residence	Concentration Iodine (I_2)	% Removal
0 min	214 ppm	0
1/4 min	143 ppm	33.2%
1/2 min	48.0 ppm	77.6%
1 min	39.0 ppm	81.8%
2 min	28.7 ppm	86.6%
5 min	4.82 ppm	97.7%
10 min	3.57 ppm	98.3%
30 min	1.78 ppm	99.2%

Lead Removal

Polyester Base Material

Residence	Concentration Lead (Pb^{++})	% Removal
0 min	230± 57.6 ppb	0
1/2 min	21.9 ppb	87.6%
2 min	11.2 ppb	94.8%
5 min	7.41 ppb	95.9%
10 min	<7.43 ppb	>96.7%
30	<5 ppb	>98.4%

Chlorine Removal

Polyester Base Material

Residence	Concentration Chlorine (HOCL/OCL)	% Removal
0 min	10 ppm	0
1 min	1.4 ppm	86%
2 min	1.2 ppm	88%
5 min	1.0 ppm	90%
10 min	0.6 ppm	94%

Chloroform Removal

Polyester Base Material

Residence	Concentration Chloroform	% Removal
0	692± 77 ppb	0
1/2 min	39.6 ppb	93.7%
5 min	19.9 ppb	97.3%
30 min	19.4 ppb	97.0%
120 min	13.4 ppb	98.2%

More generally, utilizing the device of FIGURE 1, for example, one will have a high fill and pour rate while still providing excellent removal efficiency. Filling a container 11 with tap water, one could fill the container essentially as quickly as a normal faucet (in a home) would allow the water to enter the container 11 (i.e. at about 1 - 1 1/2 gallons per minute), yet effective treatment would be provided even if -- after filling -- the water were immediately poured out of the container 11. Again the pour rate would be high, on the order of about a gallon per minute. According to the invention it is desirable to ensure that the fill and pour rates are at least about 1/2 gallon per minute. Even with such fill rates, the device 10 of FIGURE 1 -- where activated carbon is utilized as the water pollutant removal material -- is capable of removing in excess of 85-90% of the organic contaminants.

FIGURES 3 through 7 show some of a wide variety of other alternatives that the top part of the container according to the invention may have.

In FIGURE 3, the container 30 has a large open top, closed off by the one piece lid 31, with a large open chamber 34. A perforated plate retainer 33 is disposed at the bottom of the open top, and a pour spout 32 provides the outlet for water from the container. The lid 31 is removed to allow filling of the container 30, and after it has been filled with water up to the level of the perforated plate 33, the lid 31 is replaced and the container may then be utilized to dispense liquid out of the pour spout 32.

In the FIGURE 4 embodiment, the container 40 contains a shallow lid 41 like the lid 31. However in this embodiment instead of there being a large open space 34 at the top of the container 40, additional water pollutant removal material is provided at the top of the container. Water is dispensed from the container 40 through the outlet (pour spout) 42. The retainer plate 43 not only retains the water pollutant removal material at the bottom of the top chamber, it has spacers 44 extending upwardly therefrom which engage the retention filter 46 surrounding the water pollutant removal material 48. Spacers 44 are also provided on the interior wall of the container 40, and on the bottom of the shallow lid 41.

In the FIGURE 5 embodiment, a particular pathway is provided for the water as it is directed into the container 50 so that it can never bypass the water pollutant removal material and flow directly to the outlet. In this embodiment, the lid 51 has an inlet 52 thereto, and the outlet or pour spout 53. Extending downwardly from the pour spout 53 is an outer solid walled tube 55, comprising part of the lid 51. Received within the outer tube 55 in sliding/sealing engagement is an inner solid walled tube 54 which is in communication with the interior of the container 50, and particularly in direct communication with the water pollutant removal material therein so that any water passing through the tube 54 must first pass through the water pollutant removal material. A perforated plate 56, which is apertured to receive the tubes 54, 55, and has spacers 57 extending downwardly therefrom to engage the particle filter 58 surrounding the water pollutant removal material, is provided below the lid 51. The lid 51 may be removable, but care must be taken to ensure that the tube 55 is aligned with the tube 54 when the lid 51 is put back into place after removal.

The embodiment of FIGURE 6 shows a container according to the invention which has a closable pour spout. In this embodiment the container 60 has a lid 61 which includes the inlet opening 62 therethrough, and an outlet opening 63 therefrom. The outlet opening has disposed therein a movable pour spout 64 which is mounted for pivotal movement about a horizontal axis by the hollow cylindrical bearing 65. As indicated by the dotted line position in FIGURE 6, the pour spout 64 may be moved to a down, closed position 66, in which case the through-extending passageway and the spout 64 is not in communication with the outlet 63, and therefore water may not be dispensed from the container 60 through the outlet 63. A perforated retainer plate 67 is disposed in the container 60 below the lid 61.

In the FIGURE 7 embodiment, the upper portion of the container, specifically the removable lid thereof, includes a filter for removal of suspended solids, which provide a structure relatively easy to clean or replace and/or enhances the operation of the water pollutant removal material within the container 70. The lid 71 is hollow, and has an inlet 72 thereto which define a chamber 73, and has a pour spout/outlet 74. At the bottom end of the chamber 73 is a replaceable filter 75, such as a suspended solids filter for removing particles. For example the filter 75 may have a pore size of 20-40 microns. Where it is desired that the filter 75 be for removal of protozoa, then the pore size will be less than 2.5 microns. Obviously with the less than 2.5 micron pore size filter 75 the fill rate of the container 70 will be reduced. Below the lid 71, spaced from the filter 75, is the perforated retainer plate 76.

The FIGURE 8 embodiment illustrates the bottom of a modification in which more than one type of water pollutant removal material is provided in the container. A container 80 of the FIGURE 8 embodiment may utilize any of the lid structures heretofore described, or any other suitable lid structure. In this embodiment, the retention device 81 -- instead of being a filter -- has impermeable side walls. This may be accomplished by coating a conventional filter retainer with a plastic or other permeable material. Spacers 82 extend from the interior walls of the container 80 to engage the retention device 81. At the bottom 83 of the retention device, it is porous, performing its normal filtering and retention functions. That is, for example, the bottom 83 of the retention filter would not be coated with an impermeable material while the rest of the retention material 81 would be.

In the bottom portion of the container 82, a biocide water pollutant removal material 84 is provided in a low volume configuration, as heretofore described. The biocide material may have an iodine base, or it may be from a variety of other materials. A porous divider plate 85, for example having a thickness of about .01-.03 inches, is provided to separate the first water pollutant removal material 84 from the second water pollutant removal material 86. For example the material 86 may be activated carbon in a low density configuration, as heretofore described. The retention device 81 impermeable sides, the spacing between the interior walls of the container 80, and the retention device 81, and the porous bottom 83, require that any water to be dispensed by the container 80 flows through both types of water pollutant removal materials. In the exemplary embodiment described above, then, all water dispensed by the container 80 would pass through the biocide 84 material and the organics removal material 86.

Other, second, water pollutant materials could also be utilized. For example lead (or other heavy metal) specific ion exchange resins may be utilized for removal of other pollutants.

In the FIGURE 9 embodiment, too, two different types of water pollutant removal materials are utilized. However in this embodiment, the second water pollutant removal material is positioned in a much different manner than in the FIGURE 8 embodiment.

In FIGURE 9, the container 90 has an inlet tube 92 in communication with the feed opening through the lid 91. The retention device 93 has solid sidewalls. A pair of perforated plastic retainer plates 94 are disposed above and below the materials 95, 96. 95 is a compressible foam, and 96 is a biocide material which -- for example -- could be in bead form (as is conventional), rather than having a low volume configuration as earlier described. Below the bottom retainer 94 is a water space 96′, and below that a

perforated plastic retainer plate 97 disposed above the water pollutant removal material 98. The material 98 is preferably an organics removal material such as activated carbon in a low volume configuration as heretofore described. The bottom 99 of the retention device 93 is porous.

In operation of the device of FIGURE 9, water introduced through the opening 92 must pass through the biocide material 96 (since it has no other place to flow), and then passes through the activated carbon or the like 98, before it flows through the porous bottom 99 and moves in the annular opening 100 to and through the retainer 101 and the pour spout 102. Thus a means is provided for directing the flow of water so it must pass through the biocide and the activated carbon.

FIGURE 10 schematically illustrates a "travel kit" embodiment. In this embodiment, the container 110 has a feed inlet 111 and a pour spout 112. Water introduced into the container must first flow through the porous polyurethane foam 113, and then through the biocidal bead material 114 (e.g. bed depth of 1/4-1/2 inch). Below the biocidal bead material is an open space 115 to which a hand held suction device may be connected via nipple 116 having air permeable/water impermeable valve 117 therein. Suction is applied to facilitate passage of the water into the container 110. Below a perforated retainer plate 120 is provided the water pollutant removal material -- such as organics removal material activated carbon in a low volume configuration -- 121, through which the water must pass before exiting pour spout 112.

The embodiment of FIGURE 11 is similar to that of FIGURE 10, except that it is designed as a large, semi-stationary device, particularly for placement in a refrigerator. The container 125 preferably has a volume of 2 to 3 gallons. Water to be treated which is introduced into container inlet 126 (which is on a removable but sealed lid 127) first passes through biocide material 128 in a low volume configuration, and then through a second water pollutant removal material 129. Preferably the material 129 is activated carbon in a low density configuration. The amount of biocide material takes up the volume of about one pint, while the activated carbon takes up about one-half gallon. A hand operated suction pump 132 optionally may be attached to the nipple 130, the nipple 130 having an air permeable but water impermeable valve 131 therein. Typically suction would be applied to the nipple 130 only during filling of the container 125. Since the sidewalls of the retention device 133 for the biocide and activated carbon are impermeable and only the bottom 136 of the retention device is water permeable, all water treated must pass through the pollutant removal materials before it can exit the pour spigot 138.

Utilizing the teachings of the present invention, for example the container system of FIGURES 1 and 2, it is possible to provide high fill and pour rates, while still providing sufficiently high residence time of the water being treated in contact with the water pollutant removal material, so that the pollutant removal efficiency is high. For example, considering a system such as illustrated in FIGURES 1 and 2 wherein the water pollutant removal material is activated carbon, it is possible to have a fill rate (and pour rate) virtually as high as the rate at which water is typically delivered from a conventional tap in a residence. That is the pour and fill rate will be at least one-half gallon per minute, and typically would be in the range of 1/2 - 1 1/2 gallons per minute. Merely by maintaining the water in the container for greater than about 30 seconds, the vast majority of the organic pollutants are removed, e.g. in excess of 85-90%. Specific examples of activated carbon, low volume configuration materials, that allow such results to be achieved are as follows: a polyester non-woven having a thickness of about 1/8 inch and weight of 3.2 ounces per square yard with a carbon loading of 200% (i.e. 6.4 ounces per square yard of a combination of carbon and binder is applied). The polyester non-woven is formed into a spiral roll configuration (see FIGURE 2) and placed in a container. Although the container is substantially filled with the low volume configuration activated carbon impregnated non-woven, in actuality only about 20% of the effective volume of the container is actually occupied. This leaves about 80% of the container that may be filled with the water being treated, yet the water within the container will be in contact with activated carbon virtually at all times, providing a residence time substantially as long as the time that the water is in the container. Also known to be effective are polyester non-wovens having a thickness of about one-half inch and a weight of either 6 ounces per square yard or 12 ounces per square yard, also having about 200% add on of activated carbon and binder combined. All such products are commercially available, and the amount of activated carbon and binder add on can be specified. For the practice of the invention it is desirable to provide an add on of about 100% or more.

While specific examples have been described above, the examples are non-limiting. In fact many other fibers can be utilized for non-wovens including polypropylene, rayon and nylon. Also the activated carbon impregnated material may have a different configuration as long as it is a low volume configuration; for example it could be in the form of a felt, a paper, or a foam. For example open cell urethane foam impregnated with activated carbon provides an excellent low volume configuration water pollutant removal material. In each of these situations it is desirable to have the water pollutant removal material occupy a significant portion of the container volume, though the material itself has a void volume of about 60-90%.

In the practice of the method of the present invention, it is possible to purify tap water utilizing a

container including the water pollutant removal material in a low volume configuration. The method comprises the steps of: (a) Filling the container with water directly from the tap at a rate of at least about one half gallon per minute. (b) Maintaining the tap water in the container at least about 30 seconds, in contact with the material, to effect removal of pollutants therefrom. And, (c) pouring purified water from the container at a pour rate of at least one half gallon per minute. Preferably the water pollutant removal material comprises activated carbon, and step (b) is practiced so as to effect removal of at least 85% of the organic contaminants of the tap water. Also preferably step (b) is practiced by filling about 10-40% of the interior volume of the container in a substantially uniform configuration with activated carbon in a porous sheet form -- that is providing the material with a void volume of about 60-90%.

Claims

1. A container (10) for purifying water comprising: a body (11) having a hollow interior (12) of a given effective volume; and an inlet (24) to said hollow interior and an outlet (25) therefrom; characterized by a water pollutant removal containing material (14) in a low volume configuration substantially evenly distributed in said effective volume and having a void volume of about 40-90%, so as to achieve long residence times of water in contact with said pollutant removal material, while providing high fill rates and high pour rates for the container.

2. A container as recited in claim 1 further characterized in that said water pollutant removal material (14) is in a configuration selected from the group consisting essentially of material impregnated fibers, non-wovens, wovens, papers, felts, and foams.

3. A container as recited in claim 1 further characterized in that said water pollutant removal material comprises fibers including activated carbon material in a spiral roll (16) configuration, portions thereof being within the majority of the effective volume of said body.

4. A container as recited in claim 1 further characterized in that said material is contained within a retention filter (20) within said hollow interior.

5. A container as recited in claim 4 further characterized by said retention filter is spaced from the interior walls of said body by spacing means (19), so as to define a passageway (21) between said interior walls and one of said inlet and said outlet.

6. A container as recited in claim 5 further characterized in that said retention filter is porous only at the bottom thereof and has an inlet at the top thereof, being non-porous at most of the rest of the portions thereof so as to require water being treated to flow from the inlet through the bottom thereof to escape said container.

7. A container as recited in claim 1, wherein said water pollutant removal material comprises a first material, and further characterized by a second water pollutant removal material (48) disposed within said hollow interior, said second material cooperating with said first material to remove different types of pollutants from the water.

8. A container as recited in claim 1 further characterized in that said water pollutant removal containing material comprises a non-woven cloth (15) impregnated with activated carbon and binder, said cloth having a thickness of at least about one-eighth inch, a weight of at least about three ounces per square yard, and at least 100% add on of activated carbon and binder combined.

9. A method of purifying tap water utilizing a container (10) including a water pollutant removal material (14) in a low volume configuration, by practicing the steps of: (a) filling the container with water directly from a non-pressurized tap at a rate of at least about one half gallon per minute; and (b) pouring purified water from the container at a pour rate of at least about one half gallon per minute; characterized by the step, between steps (a) and (b) of (c) maintaining the tap water in the container at least about 30 seconds, in contact with the material, to effect removal of contaminants therefrom.

10. A method as recited in claim 9 wherein step (c) is facilitated by rolling up a sheet (15) of activated carbon impregnated material into a spiral roll (16), the roll having a width substantially equal to the height of the container, and inserting the roll into the container to thereby fill about 10-40% of the interior volume (12) of the container in a substantially uniform configuration with activated carbon in a porous sheet form.

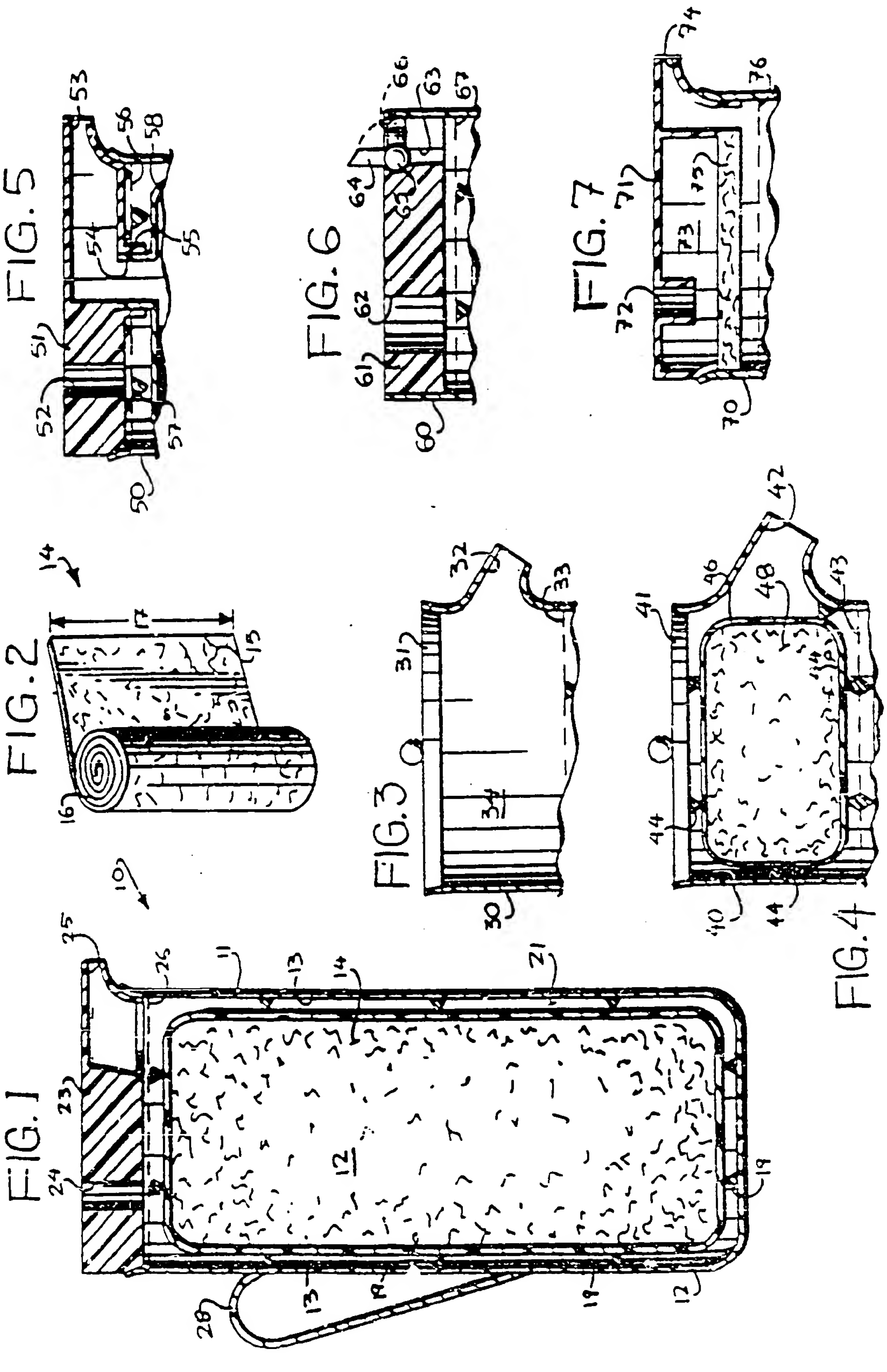


FIG. 1

FIG. 2

FIG. 3

FIG. 4

FIG. 5

FIG. 6

FIG. 7

FIG. 10

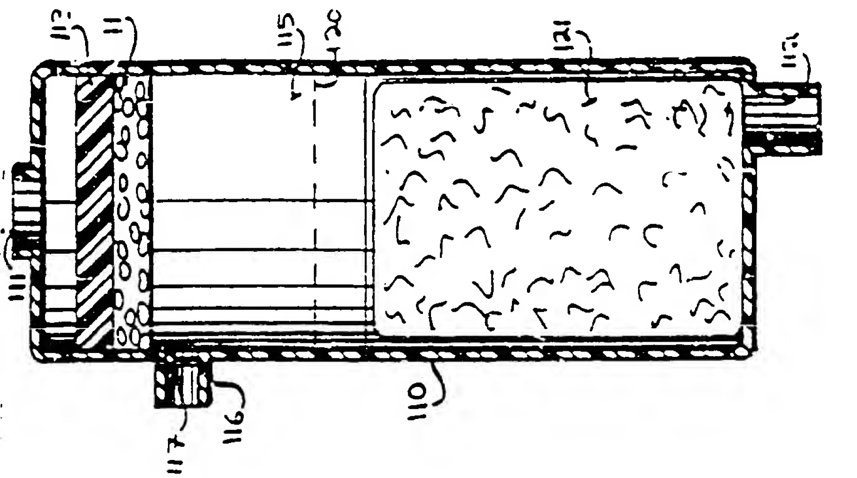


FIG. 9

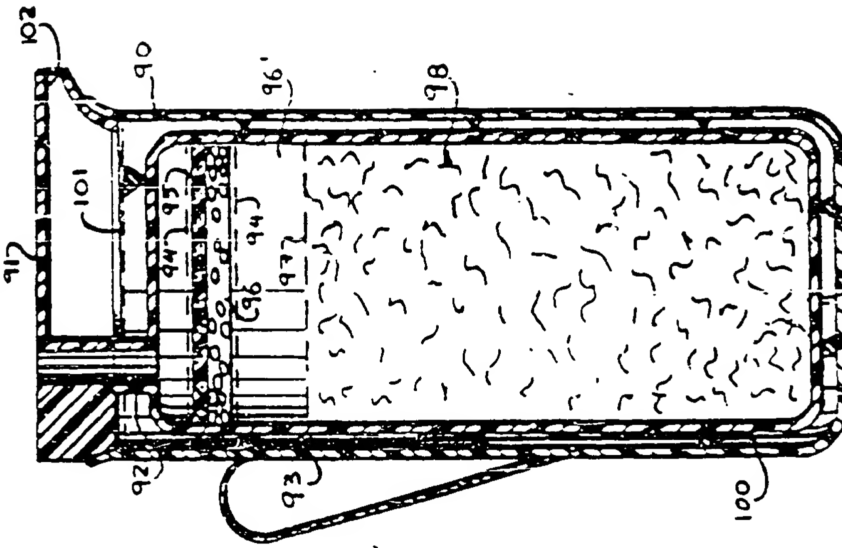


FIG. 8

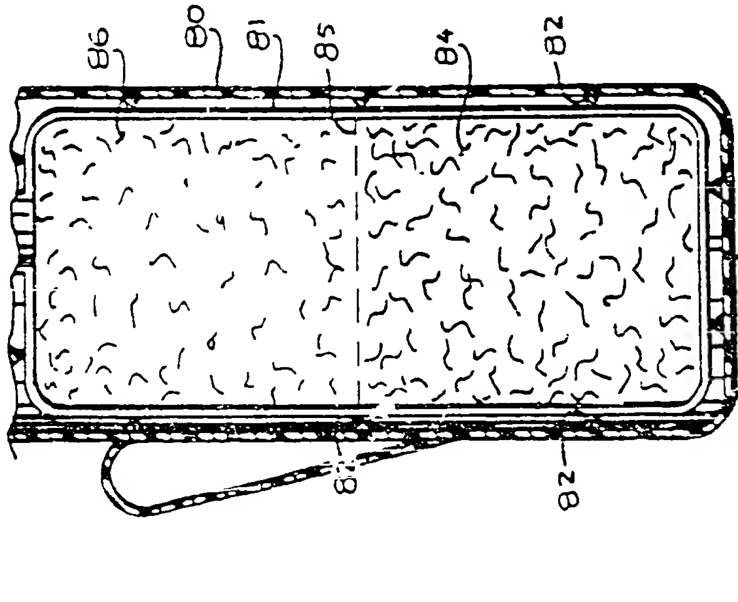
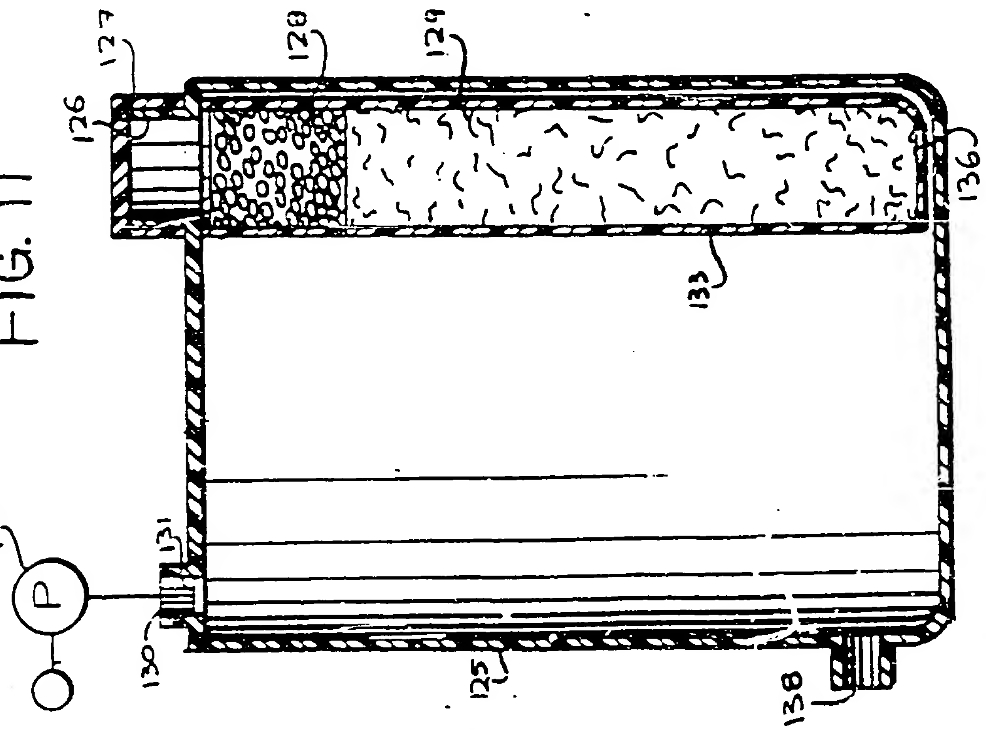


FIG. 11



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Application Number

EP 90 10 9569

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int. Cl.5)
A	PATENT ABSTRACTS OF JAPAN, vol. 12, no. 258 (C-513), 20th July 1988; & JP-A-63 042 790 (NIPPON YOKI KOGYO) 23-02-1988	1	C 02 F 1/28 C 02 F 1/00 C 02 F 1/50 B 01 D 35/04 C 02 F 9/00
A	PATENT ABSTRACTS OF JAPAN, vol. 9, no. 228 (C-303), 13th September 1985; & JP-A-60 087 888 (SHIGEMI UCHIDA) 17-05-1985	1	
A	DE-A-2 233 002 (SVIKOVSKY et al.) * Claims 1,3 *	1,2,4,7	
A	US-A-4 540 489 (R.W. BARNARD) * Column 4, lines 1-6 *	2,3	
A	US-A-4 836 921 (HAHN) * Column 4, lines 12-17 *	1,2	
A	GB-A-1 199 418 (PUROLATOR) * Figures *	1	TECHNICAL FIELDS SEARCHED (Int. Cl.5)
A	GB-A-1 259 154 (PUROLATOR) * Figures *	1	C 02 F B 01 D
A	US-E- 20 494 (BURHANS)(05-04-1937) * Figures 1,2 *	1	
A	US-A-4 110 219 (MAPLES) * Abstract; figures 8,9 *	1	
A	US-A-4 695 379 (INNOVA/PUR WATER)		

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
THE HAGUE	02-10-1990	KASPERS H.M.C.

CATEGORY OF CITED DOCUMENTS

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